APPENDIX A. BACKGROUND

This section provides:

> *Background information on the evolution of the architecture discipline*
>
> *Background on the evolution of GCCS.*

HOW ARCHITECTURE BECAME ARCHITECTURE AND HOW GCCS ARCHITECTURE EVOLVED

The concept of developing a system architecture is not a new one. Since the early development of systems engineering, whether it was in the shape of formal documentation or simply a concept in an engineer's mind, some sort of "map" illustrating an organization's information flows and requirements and how these requirements were going to be met, was generated prior to fabricating the final operational system. This makes sense. After all, the designer of a car can't build a car without a prior understanding of what the components of the car are and how they relate to one another. It is this "structure of components, their interrelationships, and the principles and guidelines governing their design and evolution over time" that we commonly refer to today as architecture[1]. What has changed over the years, and what is continually changing as technological advancements are made, are the types of architectures that are developing.

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[1] IEEE STD 610.12

THE DEVELOPMENT OF ARCHITECTURE

In the 1960s, when automated processing technology was in its infancy, many organizations used primitive computer networks consisting primarily of large mainframes, with users accessing the data and processing capabilities via "dumb terminals." The architectural drawings for these networks began from humble roots as data flow diagrams, processing charts, and other such flow or behavior charting representations. These flow charts, though not referred to as "architectures" at the time, represent the dawn of the architecting discipline. Much of the coding at this time began to exploit the time saving advantages offered by the developing third generation software languages such as FORTRAN and COBOL.

During this period, these architectures were typically designed to support calculations or transaction processing. They were not seen as a tool for enhancing the dissemination of strategic information. All processing was done on one tier, the mainframe computer. User inputs and computer output displays were functions performed by dumb terminals, and connections between the dumb terminals and main processor were primarily within the same building. Under this type of architecture, all dumb terminals were connected to the same mainframe in a one-to-many relationship[2]. Additionally, all of the hardware components of these austere networks were typically from the same computer manufacturer. This generally rendered them uninteroperable with other mainframe and terminal networks. For this reason, the transfer of information was typically reserved to that via voice. The architectures of the time did not have the capabilities of today's architectures to support the transfer of electronic information such as raster maps, digitized situation reports (SITREP), or maritime tracking signals. Figure A-1 helps to illustrate this primitive system architecture.
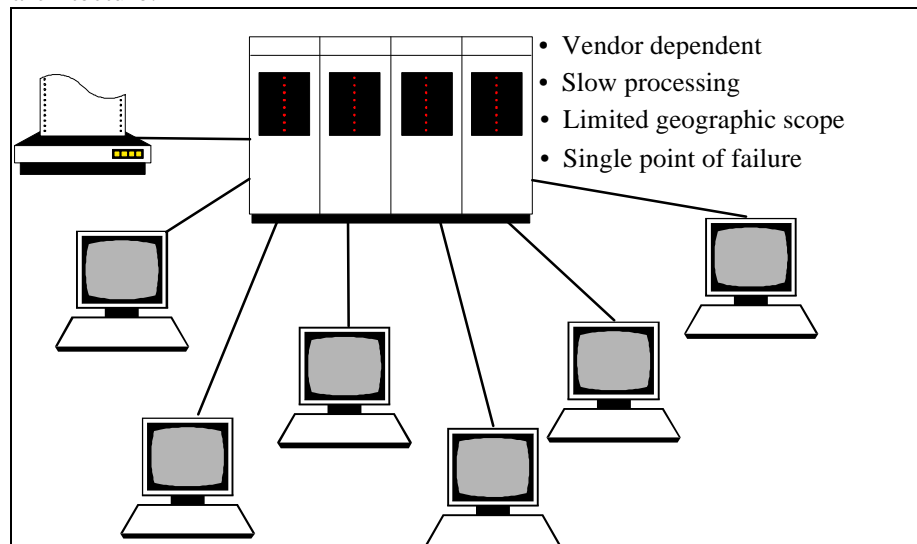

- Vendor dependent
- Slow processing
- Limited geographic scope
- Single point of failure

Figure A-1.

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[2] Laudon & Laudon, <u>Management Information Systems: Organization and Technology, </u>1994

As the 1980s arrived, this type of one-tier mainframe architecture depicted in Figure A-1 eventually became inefficient and moved to the wayside as faster and more powerful hardware was developed. These technological advancements provided organizations with greater processing capabilities. Additionally, at this time organizations began to realize the strategic importance of information. Organizations began to recognize that information meant power, and the more information rich data an organization could process, the greater advantage they would have in support of decision making. With this, computer based information systems (CBIS) began to break-away from this single tier type of architecture and to adopt architectures that exploited the advancing computer technologies that were beginning to develop in the 1980s. No longer were processing capabilities to be reserved to a single mainframe computer, and no longer was electronic information to be retained within the confines of a single office building.

The technological advancements being made in the development of CBIS architectures began to provide users with increased processing power on their desktops, and with the ability to transfer and share electronic data across larger geographical distances by using the commercial telecommunications infrastructure. At this stage, client/server architectures were being developed to split some processing functions between desktop workstations and powerful servers. This represented the development of the two-tier architectures splitting processing functions across two levels, the desktop workstation or client and the server. Figure A-2 provides a graphical depiction of the two-tier architecture. Additionally, more hardware manufacturers began to produce a mixture of heterogeneous hardware components that were being used in the evolving architectures. This required the development of standards so that various heterogeneous networks could communicate strategic information in a process that seamed to be transparent to the system users.
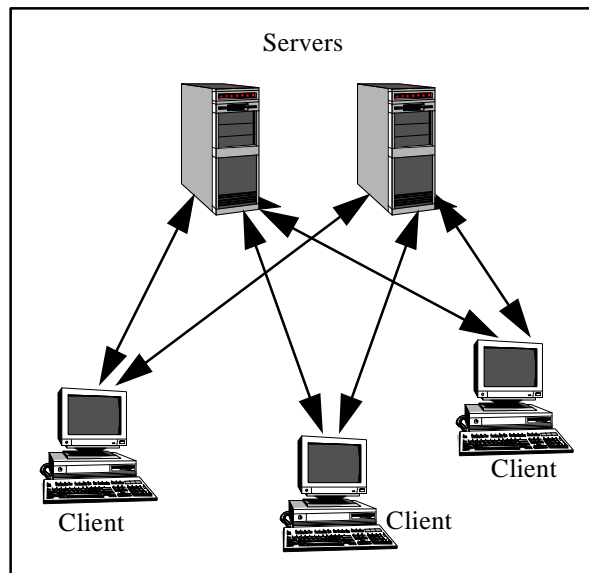

Figure A-2.
The Two-Tier Architecture

As the strategic significance of information continued to gain importance, CBIS architectures further developed to exploit the advantages offered by the new emerging technologies and to automate and facilitate the sharing of this information across greater distances. The architectures that were and continue to be developed in the 1990s were beginning to be truly global as organizations needed to share real-time information to various geographical locations around the world. These architectures provided greater flexibility with respects to: employing standards to accommodate vendor independent hardware components; processing and transferring data at higher speeds and greater bandwidths; providing more reliable file transfer and electronic data interchange protocols; taking advantage of wireless media such as T-1 links and satellite communications (SATCOM) capabilities; and allowing for more flexible network expansion capabilities. The advancements made in the telecommunications industry has been the primary feature driving the evolution of today's architectures. Today's architectures have evolved into global wide area networks providing strategic information to a multitude of users dispersed throughout the world.

Today, the development of excellent system architectures has evolved into an art, as well as a science. Designing extremely complex systems with nontraditional system requirements requires the human in the loop, the architect. The architect is tasked to make decisions on how best to portray the system so that it may be understood by others, and it is those decisions that form the basis of the architect's work. Because of this, one must understand the true intricacies involved in architecting.

The architect's intellectual knowledge base provides the architect with the necessary tools to exercise the technical discretion required in designing a system. However, we must understand that frequently system requirements arise that are extremely difficult to approach with a standard scientific rule base. *Some things just can't be done*! At this point the architect must depart from their scientific rule base and exercise intuitive common sense. It is an art for the system architect to handle unstructured problems and generate nontraditional solutions that satisfy user requirements. There is an art to creating, through intuition and pragmatics, an evolutionary solution to nonconventional problems. However, it is imperative to keep in mind that there is no single "architecture." There are many "types" of architectures. The sources mentioned in Chapter 1 of this document are excellent references to research when trying to acquire a better and more complete understanding of "architectures."

THE EVOLUTION OF GCCS ARCHITECTURE

The evolution of the GCCS architecture parallels that of the "architecting" evolution described above. Through DISA, the DoD envisioned the command and control environment of the 21st century to be one where strategic information can be shared jointly across all departments of the DoD. DoD's vision of GCCS is for it to be an architecture that promotes a migration strategy into an open systems environment that supports the warfighter. The DoD, trying to maximize the value of the information available to it, is migrating to this joint shared information environment, using the GCCS architecture as the vehicle.

The impetus of the GCCS architecture development is the result of two motivating factors. One factor is the JCS's desire to fully exploit all of the strategic information it has and providing it to the warrior -- the one actually fighting the battles. The DoD has identified the need for a baseline information system that is geared to providing the information needed for battle in the Joint environment. The system of the past, the World-Wide Military Command and Control System (WWMCCS), is spawning the GCCS architecture. The second motivating factor for the evolution of the GCCS architecture is the implementation of the C4I For The Warrior concept.

The accelerating battle management trend in recent years has been one towards "come as you are battles", Joint operations, and nontraditional force packaging. Command and control has to have the flexibility concurrent with the military changes our forces are currently under-going. The evolving architectures must logically take advantage of the continuously advancing CBIS capabilities to support these military changes. In this regard, the plethora of DoD C3 systems is rapidly converging towards a single, scalable, and deployable command and control system capable of being used by all levels of command.

C4I For The Warrior sets forth the high-level GCCS Functional Architecture detailed in the next section. The evolution of the GCCS three-tier architecture provides the DoD with a distributed computing system that supports the C4I For The Warrior concept[3]. This three-tier architecture addresses the issues of integrating object, relational, and legacy systems while migrating to client/server technology. The GCCS architecture is under constant evolution. It is, and must continue to be under constant pressure for change and innovation as new requirements continue to emerge in order to provide the most flexible support to the warfighter.

GCCS FUNCTIONAL ARCHITECTURE

The GCCS architecture is evolving from the high-level GCCS Functional Architecture. The GCCS Functional Architecture describes the architectural concept and the warfighting mission areas supported by GCCS. It identifies functional and organization relationships and structures an approach for

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[3] Defense Information Systems Agency, <u>GCCS Technical Architecture (CIRCA 2000)</u>, June 1994

developing interoperability requirements across mission areas. The C4I For The Warrior Functional Architecture has been designated as the GCCS Functional Architecture[4]. As in any other architecture, the GCCS Functional Architecture encompasses many other viewpoints and levels of increasing detail, but the Functional Architecture will only detail the functionality required, not the specific system component requirements needed to support the required functionality. The highest or top level in the GCCS Functional Architecture is depicted in Figure A-3 and details the hierarchical relationship of the GCCS Functional Architecture.
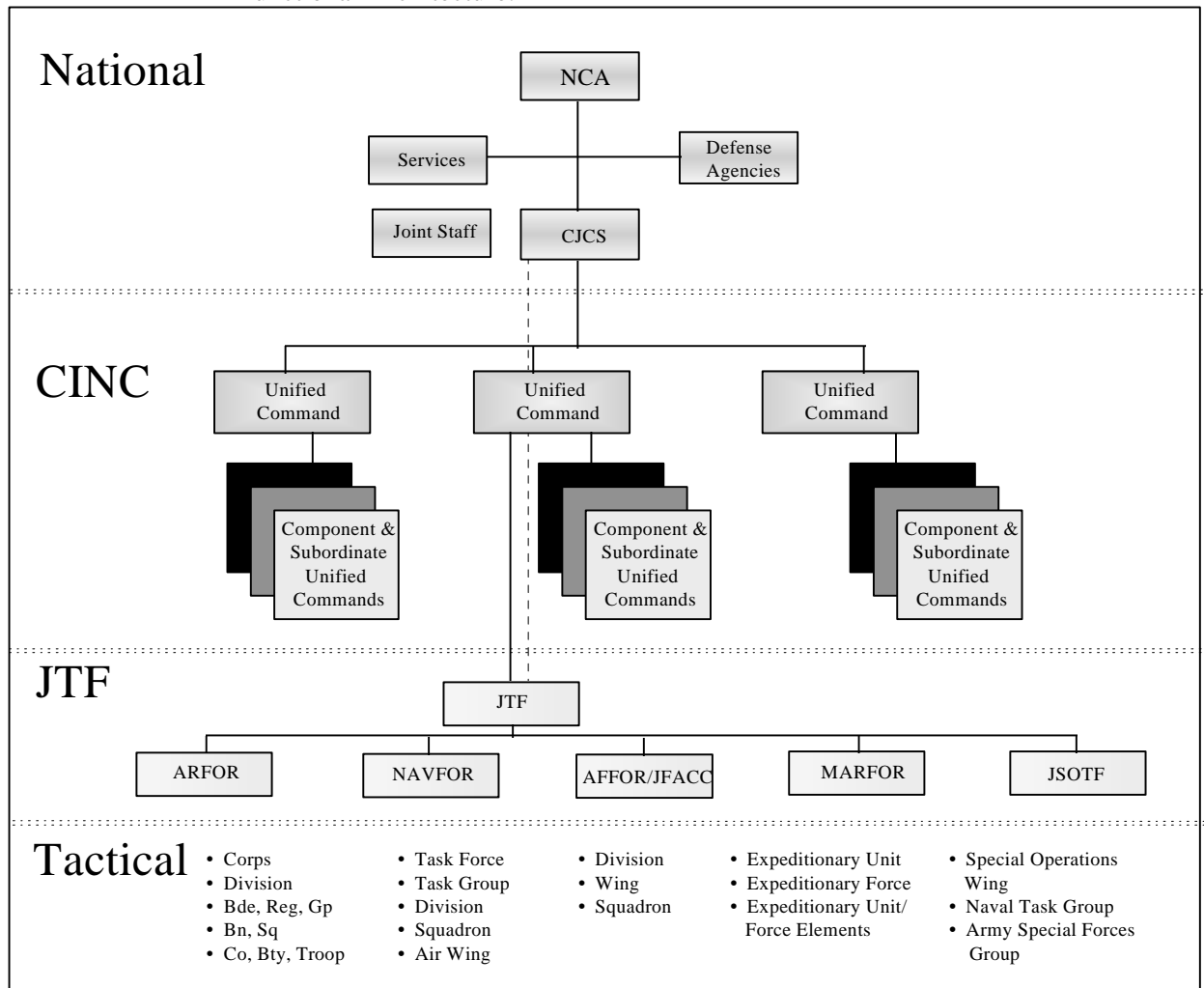
Figure A-3.
GCCS Functional Architecture

Figure A-3 illustrates the interrelationship of the functionality at each command level to support the core functions for command and control, crisis planning, force deployment, force employment, logistics, air operations, fire support, intelligence, personnel, position and narrative information. The GCCS Functional Architecture supports functional requirements at four interrelated command levels:

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[4] Defense Information Systems Agency, GCCS Technical Architecture (CIRCA 2000), June 1994

- National

- CINC

- JTF

- Tactical.

Generally, each layer interacts with services from the layer below it and/or above it, and functions at the same level often interoperate. The GCCS functional requirements at the four different command levels are discussed below.

National

The national level consists of the National Command Authorities (NCA), the Services, the Defense Agencies, and the Chairman of the Joint Chiefs of Staff (CJCS) and the Joint Staff. The President is the highest authority in the NCA and coordinates and communicates with the CJCS. GCCS functional requirements at this level must support the mission areas of strategic planning; national intelligence; and direction, employment, support and training of the Armed Forces (Services).

CINC

The CINC is the designated commander of a specific Unified Command (e.g., U.S. European Command, U.S. Pacific Command, U.S. Atlantic Command, U.S. Southern Command, U.S. Central Command, U.S. Space Command, U.S. Special Operations Command, U.S. Transportation Command, and U.S. Strategic Command) and reports to the CJCS. The Unified Commands have broad, continuing missions and are composed of forces from two or more military service departments. GCCS functional requirements at this level must support the CINC and subordinate service components commanders to accomplish assigned missions. The functions supported include the planning, organization, deployment, and employment of assigned forces to accomplish missions through GCCS information technologies.

JTF

The Joint Task Force (JTF) has a specific limited objective and interfaces with the CINC, tactical level, and may have an alternative command path to the CJCS (dependent on the contingency or mission). The JTF is comprised of Army Forces (ARFOR), Navy Forces (NAVFOR), Air Forces (AFFOR) or Joint Forces Air Control Central (JFACC), Marine Forces (MARFOR) and Joint Special Operations Task Force (JSOTF) elements. These elements are under the operational control of a Command Joint Task Force (CJTF) who is designated by the CINC responsible for missions in the designated area of operations. GCCS functional requirements at this level must support the employment of assigned forces to support assigned operational missions.

Tactical

The tactical level interfaces with the JTF level through the JTF components and CJTF. GCCS is envisioned to support the forces and resources that are employed to accomplish assigned missions at the tactical level. The functional requirements needed to accomplish missions include applications that are

specific to air, land, or maritime warfare such as mission planning, common view of the battlefield, and access to strategic and tactical intelligence.

APPENDIX B.
SOURCES FOR OBTAINING GCCS INFORMATION

SOURCES FOR OBTAINING GCCS INFORMATION

This appendix provides the locations of GCCS information that is available in an electronic format. GCCS information is available on electronic bulletin boards via the WWW. This appendix identifies where the GCCS information is located electronically, and describes the procedures for obtaining the GCCS information.

ELECTRONIC SOURCES FOR OBTAINING GCCS INFORMATION

World Wide Web

GCCS information is located on DISA's WWW bulletin board. The following instructions describe the procedures to follow when trying to locate these GCCS files.

Upon entering the WWW, use the URL: http://www.disa.mil. This will "jump" you directly to the DISA Home Page. Once on the DISA Home Page, scroll down to the section entitled *DISA Services*. Select the heading "*GCCS - New GCCS Home Page,*" with dates, definitions, and actions. This action will take you to the GCCS Home Page. Under the GCCS Home Page, scroll down to the heading *GCCS Topics*. Under *GCCS Topics* are listed the following headings:

- Instructions on Downloading GCCS Documents

- GCCS Information - Schedules, Briefings, Meeting Minutes

- GCCS Organizational Information - Who's Who in GCCS

- GCCS Program Documents

- Other Web Servers - Other servers of interest to the GCCS community.

To select the specific topic you desire, scroll down and highlight the file of interest. To select the desired topic, simply "point and click" on the desired topic. This will open the document you desire.

The topics listed above are followed on the GCCS Home Page with a section entitled, *What's New in GCCS*. This section contains new and up-to-date information on GCCS, such as:

- June 95: GCCS COE MM Working Group Time.

- June 95: User Forum: Send questions/suggestions to the GCCS Home Page POC.
- June 95: Style Guide Working Group Meeting Announcement.

The GCCS Home Page Point of Contact is: LT Michelle Smith, smith5m@cc.ims.disa.mil.

GCCS Topics on the GCCS Home Page

The following sections provide information on the topics listed under *GCCS Topics* on the GCCS Home Page.

Instructions on Downloading GCCS Documents

This page provides detailed instructions on downloading the GCCS documents. The web browsers provide several options for downloading selected files. This page describes those procedures. All GCCS documents available for downloading have been compressed using the GNU gzip compression utility. This page contains the "gzip" program for both DOS and Mac users, and can be downloaded to your machine from this page.

GCCS Information - Schedules, Briefings, Meeting Minutes

This page contains information on GCCS schedules and briefings, including the minutes of the various GCCS meetings (this section is currently under construction as of the printing of this document).

GCCS Organizational Information - Who's Who in GCCS

This page contains a listing of the various GCCS groups in DISA. This page provides; names, addresses, telephone numbers, and E-mail addresses for key points of contact.

GCCS Program Documents

This page provides a listing of the GCCS documents available for downloading. On each document's page is listed a version of the document in compressed format, either in WordPerfect 5.1 or PostScript. Under this heading is the table of contents for that document.

Other Web Servers - Other servers of interest to the GCCS community

Other Web Servers provide a collection of links that may have information of interest to the GCCS community. This includes connection to Army, Navy, and

other servers containing GCCS information. These servers can be located under the following URLs:

- http://www.dtic.dla.mil:80/airforce/link

- http://www.stl.nps.navy.mil/c4i

- http://www.army.mil

- http://hakita.nosc.mil/gccs/goal.html

- http://164.117.208.50/newgoal.html

APPENDIX C. ARCHITECTURE TOOL EVALUATION REPORTS

This section provides:

> *A brief summary of effort to review candidate tools to support the GCCS Architecture process*

> *A table which identifies the capabilities of each tool evaluated.*

INTRODUCTION

The GCCS architecture tool evaluation described in this section was conducted during June and July of 1995 under the commission of DISA/JIEO Center for Systems Engineering GCCS Architect. The information presented in this appendix reflects product capabilities and data current at that time. We recognize that software products are continually being upgraded and new products are emerging on the market. The information in this appendix will be updated, or a new evaluation conducted, on a periodic basis.

Before making a purchase decision, always consult current product literature and software reviews in technical publications to verify the current status of a product listed in this appendix. Testing the application prior to purchase is also highly recommended.

METHODOLOGY

Each tool was reviewed on the basis of four major functional categories: Drawing, Data Handling, Ease-of-Use, and Advanced Features. These categories represent the broad groupings of functional requirements and objectives for automated tools which will support the GCCS architecture development and analysis process. In the Drawing category, a review of the products' drawing tools, image libraries, and importing/exporting and printing capabilities was conducted. In the Data Handling category, products were reviewed in terms of their capabilities for storing, viewing, displaying, reporting and querying data linked to the icons in the drawings. The Ease-of-Use category was used to review how well each tool accomplished the desired functionality with only minimal training and how intuitive the product was to use. The Advanced Features category reviewed advanced capabilities such as

modeling and simulation and network management features of the tool. Table C-1, "Tool Capabilities", details the specific functional capabilities needed to support GCCS development and analysis, and the support provided by each of the five tools evaluated: netViz, SysDraw, ClickNet, NetGuru, and GrafBASE. These tools were reviewed with a focus on satisfying the broadest range of needs of the GCCS community. Other tools may better fit your needs, depending on the role you play. Each of the specific capabilities identified in the table are defined in greater detail in the capabilities glossary at the end of this appendix.

In order to assist the reviewers in quickly determining each tool's suitability to the requirements of supporting GCCS architecture development, analysis and implementation, a sample set of architecture drawings was devised. The drawings were created for the purpose of exercising the functional capabilities identified in Table C-1. These drawings are not intended to be realistic or to represent any actual GCCS, or Department of Defense or Federal Government information system. The information systems depicted are completely fictional and were created for the sole purpose of testing the feature sets of the tools reviewed. The first drawing included in Figure C-1 is a geographic architecture depicting three sites, Washington, D.C., New York City, and Los Angeles. The geographic architecture is shown on a U.S. map background, along with the wide area communications links that serve the sites. This drawing requires the capability to import graphics, namely the background graphic of the United States map. Each tool was evaluated using this drawing, and importing the U.S. map background in *.WMF format.
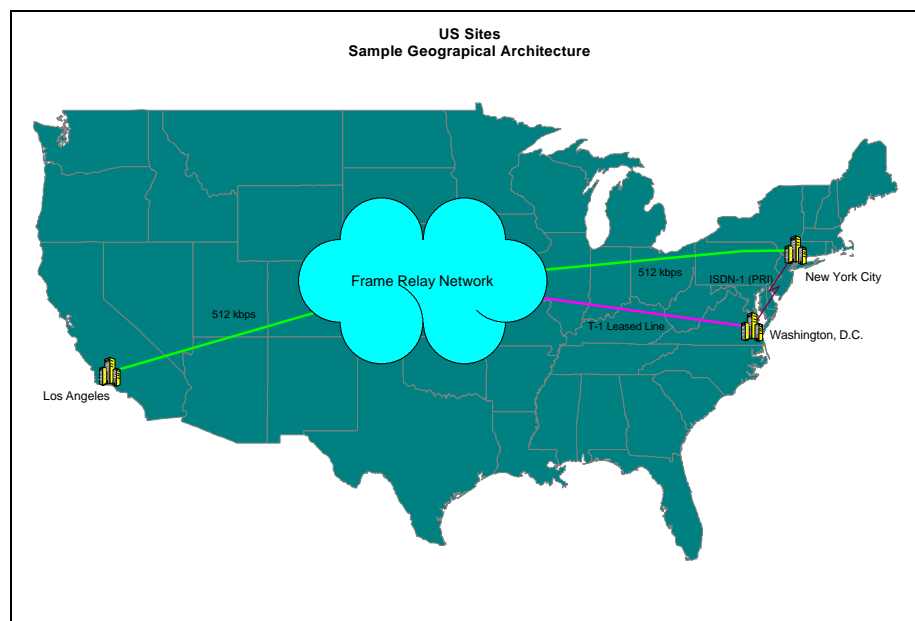

Figure C-1.
Sample Geographical Architecture Drawing

The next two drawings are both sublevel drawings of the first drawing. To support this sublevel depiction requirement, the tool must provide a multilevel, drill-down capability. The Washington, D.C. site drawing uses the GCCS 'H' drawing convention to portray a technical architecture. The drawing presented in Figure C-2 illustrates several functions and features such as object image quality, linked data display capabilities, data handling characteristics, line drawing capabilities, and standard drawing tools capabilities. Also, notice the ISDN link depicted going from the router, WDC Rtr_01 in the top right portion of the drawing, to an icon representing the router in the New York City drawing, NYC Rtr_01. This requirement tested the capability to link between layers or drawings.

Washington, D.C.
Sample Technical Architecture

ISDN-1 (PRI)
NYC Rtr_01

WDC Rtr_01

WDC NetSrv_01
32 Mb
Netware 4.0

Database Server-1
64 Mb
10 Gb
Oracle 7.1

Ethernet
Segment 3

WDC HP4MV_431

WDC Fiber Backbone

P5-90   John
20 Mb
540 Mb

P5-90   Rick
20 Mb
540 Mb

Ethernet
Segment 1

P5-90   Patti
20 Mb
540 Mb

P5-90   Joy
20 Mb
540 Mb

WDC LANHub(SW)-1

Eng Sparc_01
64
1.5 Gb

Ethernet
Segment 2

Eng. Sparc_02
128
10 Gb
Sybase

RNo. 123456789GCCSARCH:EXAMPLE

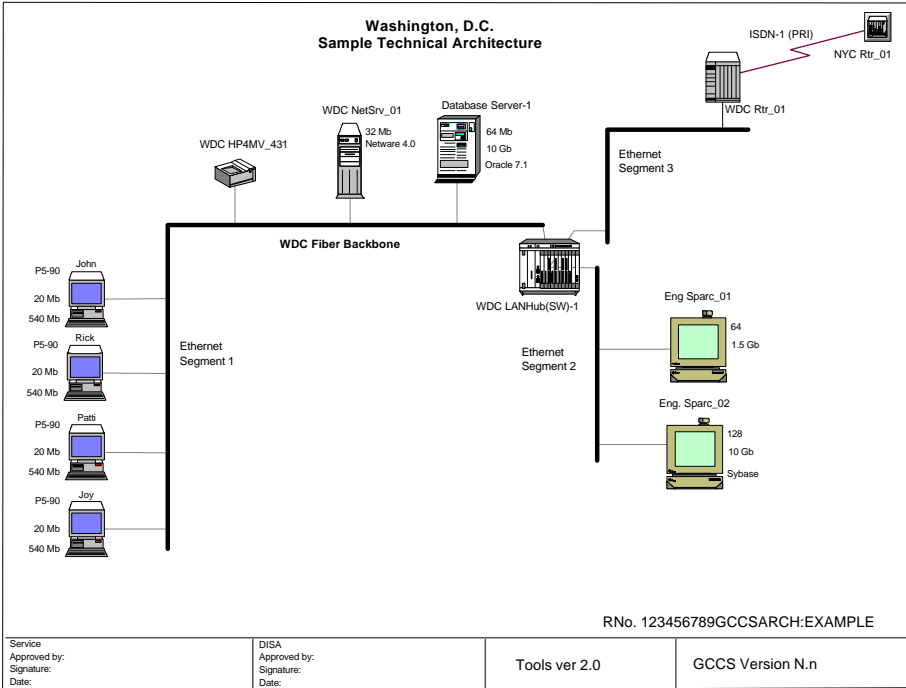| Service Approved by: Signature: Date:	DISA Approved by: Signature: Date:	Tools ver 2.0	GCCS Version N.n

Figure C-2
Sample Technical Architecture Drawing

The New York City drawing, Figure C-3, is a sample of a system design and installation architecture. This drawing required the use of a floor plan background graphic and also tested object image quality and variety, line drawing functionality, data handling and other functions. Figure C-3 shows a sample of this drawing.

New York City
Sample System Design Architecture

WDC Rtr_01

NYC NetSrv_01

Wally

Paul

Linda

Darry

486-66
16
320

Mark

P5-90
24
810

ISDN-1 (PRI)

Stacy

486-50
16
528

IBM Printer-1

Stan

486-66
16
528

NYC HP4Si_by

NYC Rtr_01

NYC TRing_01

Romulus

RNo. 123456789GCCSARCH:EXAMPLE

Service
Approved by:
Signature:
Date:

DISA
Approved by:
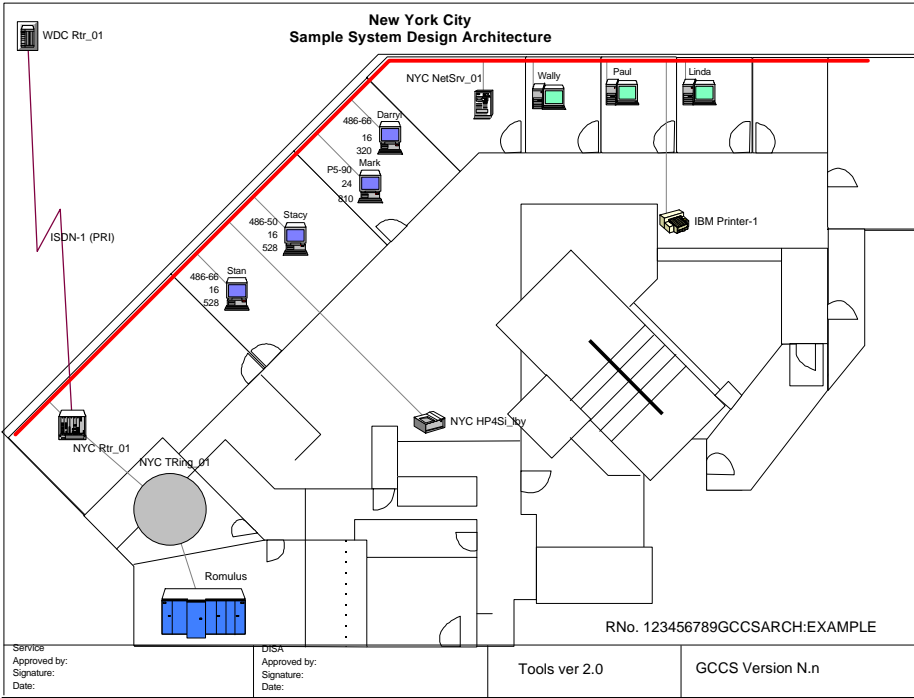Signature:
Date:

Tools ver 2.0

GCCS Version N.n

Figure C-3
Sample System Design Architecture Drawing

The reviewers studied the documentation to determine each tool's design and purpose. After gaining a good understanding of the tool's intended use, the sample architecture drawings described above were drawn using each tool. As the reviewer used the tool to create these drawings, print them, produce reports based on the data, and perform queries, the tool's suitability to support GCCS architecting and engineering efforts became apparent. During this process, Table C-1 was used to record each tool's capabilities and functionality.

It should be clearly understood that this review, and the subsequent reports, are not intended to be comprehensive evaluations or comparisons of these tools. Appendix D goes into more detail about a broader spectrum of available COTS tools. The review provided in this appendix only compares five of the several dozen tools on the market. The focus of the evaluation was on those PC-based network diagramming tools with a database. The requirements and criteria in this review can be used to evaluate other tools. The intent of this effort is simply to review the tools and determine the suitability of each one to independently support the GCCS architecture development and analyses required for implementation of GCCS worldwide.

RECOMMENDATIONS

This tool evaluation identified several tools that could complement and support the GCCS architecture methodology and conventions. Drawing, data handling, ease-of-use, and advanced features were evaluated for each tool. Although each tool has particular capabilities that could benefit GCCS, no one tool completely satisfies all foreseeable GCCS requirements. The tools listed here as "not recommended" are not necessarily bad products in and of themselves, but they are not best suited for all of the requirements for GCCS. A summary of the evaluation for each product follows.

NETVIZ. NetViz meets almost all of the functional requirements and objectives to support the GCCS community. The tool possesses the following capabilities: excellent drawing capability coupled with easy-to-use data handling capabilities, support for GCCS conventions, and a more than adequate import and export capability. netViz, like all of the other tools evaluated, is limited in network modeling and simulation, autodiscovery, and SNMP interface capabilities. netViz is best suited for easily drawing complex network diagrams for presentations and briefings. Additionally, the documentation created with netViz is useful for troubleshooting, maintenance, planning, and analysis. Highly recommended.

CLICKNET. ClickNet possesses an inadequate data display capability and no thematic layering. It requires tedious manual data entry. The data definition, reporting, and query function is inflexible, and there is no import capability for the database. Clicknet lacks modeling and simulation capabilities, autodiscovery, and SNMP interfaces. While ClickNet is not best suited for GCCS, ClickNet is an acceptable network diagramming tool that could support other applications. Not highly recommended.

SYSDRAW. SysDraw does not support GCCS conventions, thematic layering, modeling and simulation, and does not provide autodiscovery or any SNMP interfaces. While not the top choice for GCCS, SysDraw is an acceptable package for network diagramming and project management record keeping. Not highly recommended.

ASSET M/V. Although this tool possesses a simple network diagramming and documenting capability, ASSET M/V's inadequate drawing capabilities with no display of linked data in the diagram, limited import/export capability, poor usability, and poor documentation makes it unacceptable for GCCS. Not recommended.

GRAFBASE. GrafBASE possesses an inadequate drawing capability, burdensome drill down capability, no thematic layering, and an inadequate and very limited import and export capability. GrafBASE may be useful for managers needing to track costs and node location using the advanced mapping capability. Not recommended.

NETGURU. NetGuru has the following limitations: a lack of drawing capability, limited data handling functionality and features, poor print quality, and no autodiscovery or SNMP capability. NetGuru, although clearly not

designed as a diagramming and documentation tool, is well suited for providing network designers and engineers a tool for planning, designing, and easily testing networks. Not recommended.

TABLE C-1: TOOL CAPBILITIES

The glossary following this table details each of the capabilities identified in the left column of the table.

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Product					
Version Number	2.0	1.401	1.62	2.0	8.0
Release Date	1Q 1995	June 1995	July 1995	May 1995	May 1995
Hardware Requirements					
Processor	386 or better	386 or better	286 or better	386 or better	386 or better
RAM	8 MB	4 MB	4 MB	4 MB	4 MB
Hard Disk Space	25 MB	8 MB	2.5 MB	6 MB	18 MB
Operating System	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0
Suggested Retail Price	$795	$875	$1589	$595	$955
Drawing					
Drag and Drop Tool Palettes	Yes	Yes	Yes	Yes	Yes
Drill Down (Multilevel diagramming)	Yes	Yes	No	Yes	Yes
Thematic Layering	No	No	No	No	No
Engineering Borders	Yes	No		Yes	Yes
GCCS Conventions	Yes	No		Yes	No
Zoom In/Out	Yes	Yes	Yes	Yes	Yes
Standard Drawing Tools	Yes	Text only	Yes	Yes	Yes
Icon Images	Yes	Yes	Yes	Yes	Yes
Image Library	2,300	45	Yes	400	2,000
Import Images	Yes	Yes	No	Yes	Yes
Linked Data					
Display	Yes	Yes	Yes	Yes	No
Select Fields to Display	Yes	Yes	No	Yes	No
Modify Display Properties	Yes	Some	No	Yes	No
Movable Display Text	Yes	Yes	Yes	Yes	No
Links					
Smart Lines	Yes	Yes	Yes	Yes	Yes
Curve Lines	No	No	No	Yes	Yes
Bendpoints	Yes	Yes	No	Yes	Yes
Links Between Layers	No	Yes	No	Yes	Yes
Different Line Styles	Yes	Yes		Yes	No

Table C-1 (Cont'd.)
Importing Formats

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Importing					
Icon Symbol Formats					
*.BMP	Yes	Yes	No	Yes	No
*.CGM	No	No	No	Yes	Yes
*.DXF	No	Yes	No	Yes	Yes
*.DRW	No	No	No	Yes	Yes
*.EPS	Yes	No	No	Yes	No
*.GIF	Yes	No	No	Yes	No
*.ICO	No	Yes	No	Yes	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	Yes	No	Yes	No
*.TGA	Yes	No	No	No	No
*.TIF	Yes	No	No	Yes	No
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Background formats					
*.BMP	Yes	Yes	No	Yes	No
*.CGM	No	No	No	Yes	Yes
*.DRW	No	No	No	Yes	Yes
*.DXF	No	Yes	No	Yes	Yes
*.EPS	Yes	No	No	Yes	No
*.GIF	Yes	No	No	Yes	No
*.ICO	No	No	No	Yes	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	Yes	No	Yes	No
*.TGA	Yes	No	No	No	No
*.TIF	Yes	No	No	Yes	No
*.TXT	No	No	No	No	Yes
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Exporting					
Save As...					
*.BMP	Yes	Yes	No	No	No
*.CGM	No	No	No	No	Yes
*.DRW	No	No	No	No	Yes
*.DXF	No	No	No	No	Yes
*.EPS	Yes	No	No	No	No
*.GIF	Yes	No	No	No	No
*.ICO	No	No	No	No	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	No	No	No	No

Table C-1 (Cont'd.)
Exporting (Cont'd.)

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
*.TGA	Yes	Yes	No	No	No
*.TIF	Yes	No	No	No	No
*.TXT	No	No	No	No	Yes
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Copy-and-paste	Yes	Yes	Yes	Yes	Partially
OLE Compatible	No	No	No	No	Yes
Print Quality	Good	Poor	Fair	Good	Good
Data Handling					
Icons Linked to Data	Yes	Yes	Yes	Yes	Yes
Modify Data Fields	Yes	Yes	No	Yes	Yes
Importing					
ASCII (delimited text)	No	Yes	No	Yes	Yes
ODBC Compliant	Yes	No	No	No	Yes
Native DBMS Formats	No	No	No	No	Yes
Exporting					
ASCII (delimited text)	Yes	Yes	Yes	Yes	Yes
ODBC Compliant	Yes	No	No	No	Yes
Native DBMS Formats	No	No	No	No	Yes
Copy (Cut)-and-paste	No	No	Yes	Yes	No
Reports					
Predefined	Yes	Yes	Yes	No	Yes
Customized	No	No	No	No	Yes
Ad-hoc	No	Yes	No	Yes	Yes
Query Capability	Partially	Yes	Yes	Yes	Yes
Query Result Formats (tabular, forms, text reports, graphs)	Built-in report facility: text report Using ODBC DBMS: as provided by DBMS	Tabular, Text	Screen list	Tabular	Forms, Reports
Ease-of-Use					
General (good, fair, poor)	Good	Fair	Fair	Good	Good
Navigation (good, fair, poor)	Good	Fair	Good	Good	Good
Documentation (good, fair, poor)	Good	Fair	Fair	Good	Good
On-Line Documentation	Yes	Yes		Yes	Yes

Table C-1 (Cont'd.)
Ease-of-Use (Cont'd.)

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Context Sensitive Help	No	No		Yes	Yes
Bubble Help	Yes	Yes	No	Yes	Yes
Tutorials/Tours	No	Yes	No	Yes	Yes
Advanced Features					
Modeling & Simulation	No	No	Yes	No	No
Interface to SNMP-based Logical Network Mgmt.	No	No	No	No	No
Autodiscovery	No	No	No	No	No

TOOL CAPABILITIES GLOSSARY

The following glossary provides a brief description of the terms used in the table to describe the features and ratings of each tool. The table entries are very brief, and should not be used alone to understand a tool's suitability for a particular task. Before making any purchase decision, we recommend you obtain both current vendor information and the full tool reports from DISA's July 1995 evaluation of architecture tools, or another reliable, independent review. Areas in which a tool is particularly strong or weak, or in which the tool had notable problems is described in greater depth in the reports.

Product Information about the product that is administrative in nature. Product information includes:

Version Number

Release Date

Hardware Requirements

- Processor

- RAM

- Hard Disk Space

Operating System

Suggested Retail Price.

Drawing Each tool needs to provide the following drawing capabilities:

Drag and Drop Symbol Palettes - The tool provides tool palettes, or small separate windows showing icons representing the supporting tools or symbols available for use. Drag and Drop means the supporting tools or symbols can be clicked and dragged to the working area of the project for use.

Drill Down (Multilevel diagramming) - The capability to click on a symbol and reveal a detailed drawing of the subsystems of the location or system represented by that symbol.

Thematic Layering - A means of layering different elements of information in one drawing or diagram, much like transparent overlays. The layers can be used to portray themes, such as network wiring, client PCs, network servers, or network devices.

Engineering Borders - The capability to draw boxes or borders around sections of a network diagram.

GCCS Conventions - The ability to support the GCCS conventions detailed in Section 3 of this document.

Zoom In/Out- The capability to change the scale of the drawing.

Standard Drawing Tools - The tool has supporting generic drawing tools, such as arrows, rectangles, circles, and text.

Icon Images

- *Image Library*- How many images the tool provides for representing information system components.

- *Import Images* - The tool provides the capability to define new icons to represent information system components and bring in images to represent them.

Data Field Display - The capability to display and print data fields contained in the database around system components in a network diagram.

- *Select Fields to Display*- The capability to select which data is displayed.

- *Modify Display Properties*- The capability to change the font, color, alignment, etc. of the displayed data.

- *Movable Display Text*- The capability to move the displayed data in the diagram.

Links - Lines connecting components, usually representing communications links.

- *Smart Lines* - Lines which remain connected and move when the attached icons are moved.

- *Curve Lines*- Lines that can be curved.

- *Bendpoints*- Lines that can have bend points added.

- *Links Between Layers*- Lines that can be drawn between components in separate drawing layers or windows. This can be demonstrated by showing the line directly connecting the layers, or by placing a specially denoted symbol on each drawing representing the opposite end connection.

- *Different Line Styles* - Lines that can be different colors, thickness, etc. to differentiate between link types.

Importing - Tools should provide capability to import images from other tool or files, such as icon images and background drawings.

- *Icon Symbol formats* - Tools must support some of these standard formats:
  - *.BMP - Windows Bitmap
  - *.CGM - Computer Graphics Metafile
  - *.DXF - AutoCAD Interchange
  - *.DRW - MicroGrafx Designer drawing
  - *.EPS - Encapsulated PostScript
  - *.GIF - Graphics Interchange Format
  - *.ICO - Windows icon
  - *.JPG - Joint Photographic Experts Group (JPEG) standard
  - *.PCT - Macintosh PICT file
  - *.PCX - PC Paintbrush
  - *.TGA - Targa image
  - *.TIF - Tagged Image File
  - *.WMF - Windows Metafile
  - *.WPG - Word Perfect Graphic

- *Background formats*
  - *.BMP - Windows Bitmap
  - *.CGM - Computer Graphics Metafile
  - *.DRW - MicroGrafx Designer drawing
  - *.DXF - AutoCAD Interchange
  - *.EPS - Encapsulated PostScript
  - *.GIF - Graphics Interchange Format
  - *.ICO - Windows icon
  - *.JPG - Joint Photographic Experts Group (JPEG) standard
  - *.PCT - Macintosh PICT file
  - *.PCX - PC Paintbrush
  - *.TGA - Targa image
  - *.TIF - Tagged Image File
  - *.TXT - ASCII text file
  - *.WMF - Windows Metafile
  - *.WPG - Word Perfect Graphic

Exporting - Tools need to provide some capability to view and manipulate network diagrams in other applications. This ability can be accomplished by saving diagrams in various file formats, by copy-and-paste, or by MS Windows Object Linking and Embedding (OLE).

- *Save As...*
  - *.BMP - Windows Bitmap
  - *.CGM - Computer Graphics Metafile
  - *.DRW - MicroGrafx Designer drawing
  - *.DXF - AutoCAD Interchange
  - *.EPS - Encapsulated PostScript
  - *.GIF - Graphics Interchange Format
  - *.ICO - Windows icon
  - *.JPG - Joint Photographic Experts Group (JPEG) standard
  - *.PCT - Macintosh PICT file
  - *.PCX - PC Paintbrush
  - *.TGA - Targa image
  - *.TIF - Tagged Image File
  - *.TXT - ASCII text file

     *.WMF - Windows Metafile
     *.WPG - Word Perfect Graphic

  - *Copy-and-paste*- The capability to use the MS Windows clipboard method to copy a drawing, or portion of a drawing, and paste it into another MS Windows application.

  - *OLE Compatible*- The program can act as a MS Windows OLE server. If the program is OLE compatible, the OLE version (1.0 or 2.0) will be indicated on-line.

  - *Print Quality*- The quality and accuracy of the network diagram when printed.

Data Handling - Each tool needs some means of maintaining data or attribute information about the information system components represented in the drawings. This information may be stored in the form of a built-in database or interaction with an Database Management System (DBMS) of some kind.

Icons Linked to Data - The tool maintains data about information system components that is available (can be viewed or edited) by clicking on the icon or by some other user interaction.

Modify Data Fields - The capability to change what data is maintained for information system components by adding, deleting or modifying the data fields recorded for a component type.

Importing - The tool needs to provide the capability to import data from existing documents, databases or spreadsheets:

  - *ASCII (delimited text)*- Tool can import plain text.

  - *ODBC Compliant*- Tool can interact, or at least import, from databases using the Microsoft Open Database Connectivity (ODBC) standard as a translation layer.

  - *Native DBMS Formats*- Tool can import directly from the database using the DBMS' native database format.

Exporting - Tools need to provide the capability to export data to other applications, such as word processors, database management systems, or spreadsheets:

  - *ASCII (delimited text)*- Tool can export in plain text.

  - *ODBC Compliant*- Tool can interface databases using the Microsoft ODBC standard as a translation layer, allowing querying and other data operations.

  - *Native DBMS Formats*- Tool can be interfaced directly from a DBMS, or can save data in the DBMS' native database format.

  - *Copy (Cut)-and-paste*- Data can be copied, or cut, from the tool and pasted into another application.

Reports - Tool needs to provide the capability to generate reports on the data about the information system components.

- *Predefined* - Tool has predefined report formats, in which the content and format is predetermined.

- *Customized* - The user can define report contents and formats and save them for recurring use.

- *Ad-hoc* - The user must define the report content and format each time it is printed or displayed.

Query Capability - Tool needs to provide a capability to request specific information about the information system components diagrammed.

Query Result Formats (tabular, forms, text reports, graphs) - Tool shows which format can be used to display query results. Tabular results are in tables or spreadsheet format. Forms are displayed as fill -in-the-blank style screen forms. Text reports display query results in a text document format. Graphical reports display results in graph format.

Ease of Use - Each tool needs to be intuitive to the user and should be easy to learn with minimal training. The ease-of-use criteria are primarily subjective in nature, and should not be used other than as general indicators of the evaluators' experience in using the programs:

General (good, fair, poor) - A rating of the overall ease-of-use of the program, based on the evaluators' experience in using the program during the evaluation process.

Navigation (good, fair, poor) - A rating of the level of effort to accomplish typical tasks. Based on the number of menu levels or the amount of mouse movement and clicking required to accomplish most tasks.

Documentation (good, fair, poor) - The quality of the documentation is indicated based on clarity of instruction and accuracy of information.

On-line Documentation - The capability to search on a word or topic using the standard MS Windows hypertext help directory.

Context Sensitive Help - The ability to call up the help window related to the function the user is attempting to perform using the F1 function key.

Bubble Help - Small free floating tips and labels that appear when the cursor is held over a tool or image for a short period of time.

Tutorials/Tours - Tool included some form of computer based training in addition to on-line help information.

Advanced Features - Advanced features in which the tools may or may not have had capabilities:

Modeling & Simulation - The tool provides a capability to simulate the information system which is diagrammed, providing information on the validity of the design and performance characteristics.

Interface to SNMP-based Logical Network Mgmt - The program can get information from and provide information to logical network management systems such as Hewlett Packard's OpenView, IBM's NetView/6000, Computer Associates' UNICENTER, and Sun's NetManager.

Auto-discovery - The tool can automatically survey and record data on the systems connected to a network.

APPENDIX C. ARCHITECTURE TOOL EVALUATION REPORTS

This section provides:

A brief summary of effort to review candidate tools to support the GCCS Architecture process

A table which identifies the capabilities of each tool evaluated.

INTRODUCTION

The GCCS architecture tool evaluation described in this section was conducted during June and July of 1995 under the commission of DISA/JIEO Center for Systems Engineering GCCS Architect. The information presented in this appendix reflects product capabilities and data current at that time. We recognize that software products are continually being upgraded and new products are emerging on the market. The information in this appendix will be updated, or a new evaluation conducted, on a periodic basis.

Before making a purchase decision, always consult current product literature and software reviews in technical publications to verify the current status of a product listed in this appendix. Testing the application prior to purchase is also highly recommended.

METHODOLOGY

Each tool was reviewed on the basis of four major functional categories: Drawing, Data Handling, Ease-of-Use, and Advanced Features. These categories represent the broad groupings of functional requirements and objectives for automated tools which will support the GCCS architecture development and analysis process. In the Drawing category, a review of the products' drawing tools, image libraries, and importing/exporting and printing capabilities was conducted. In the Data Handling category, products were reviewed in terms of their capabilities for storing, viewing, displaying, reporting and querying data linked to the icons in the drawings. The Ease-of-Use category was used to review how well each tool accomplished the desired functionality with only minimal training and how intuitive the product was to use. The Advanced Features category reviewed advanced capabilities such as

modeling and simulation and network management features of the tool. Table C-1, "Tool Capabilities", details the specific functional capabilities needed to support GCCS development and analysis, and the support provided by each of the five tools evaluated: netViz, SysDraw, ClickNet, NetGuru, and GrafBASE. These tools were reviewed with a focus on satisfying the broadest range of needs of the GCCS community. Other tools may better fit your needs, depending on the role you play. Each of the specific capabilities identified in the table are defined in greater detail in the capabilities glossary at the end of this appendix.

In order to assist the reviewers in quickly determining each tool's suitability to the requirements of supporting GCCS architecture development, analysis and implementation, a sample set of architecture drawings was devised. The drawings were created for the purpose of exercising the functional capabilities identified in Table C-1. These drawings are not intended to be realistic or to represent any actual GCCS, or Department of Defense or Federal Government information system. The information systems depicted are completely fictional and were created for the sole purpose of testing the feature sets of the tools reviewed. The first drawing included in Figure C-1 is a geographic architecture depicting three sites, Washington, D.C., New York City, and Los Angeles. The geographic architecture is shown on a U.S. map background, along with the wide area communications links that serve the sites. This drawing requires the capability to import graphics, namely the background graphic of the United States map. Each tool was evaluated using this drawing, and importing the U.S. map background in *.WMF format.
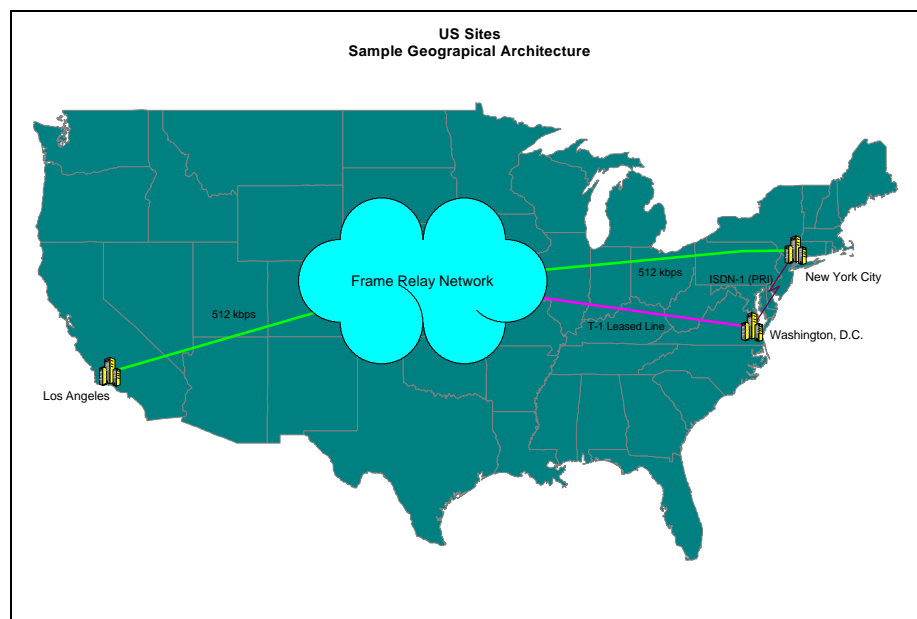

Figure C-1.
Sample Geographical Architecture Drawing

The next two drawings are both sublevel drawings of the first drawing. To support this sublevel depiction requirement, the tool must provide a multilevel, drill-down capability. The Washington, D.C. site drawing uses the GCCS 'H' drawing convention to portray a technical architecture. The drawing presented in Figure C-2 illustrates several functions and features such as object image quality, linked data display capabilities, data handling characteristics, line drawing capabilities, and standard drawing tools capabilities. Also, notice the ISDN link depicted going from the router, WDC Rtr_01 in the top right portion of the drawing, to an icon representing the router in the New York City drawing, NYC Rtr_01. This requirement tested the capability to link between layers or drawings.
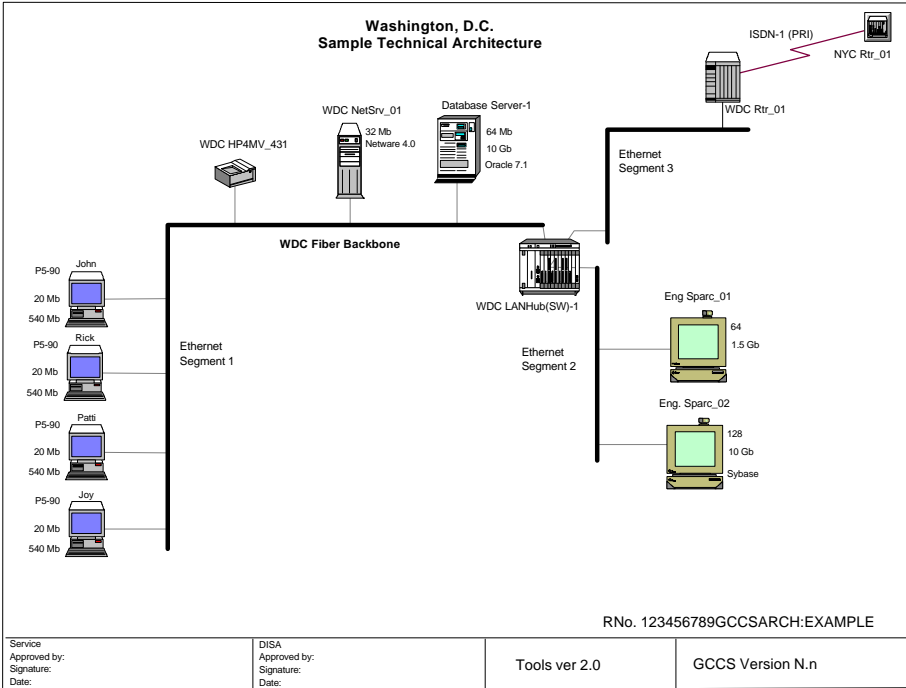

Figure C-2
Sample Technical Architecture Drawing

The New York City drawing, Figure C-3, is a sample of a system design and installation architecture. This drawing required the use of a floor plan background graphic and also tested object image quality and variety, line drawing functionality, data handling and other functions. Figure C-3 shows a sample of this drawing.
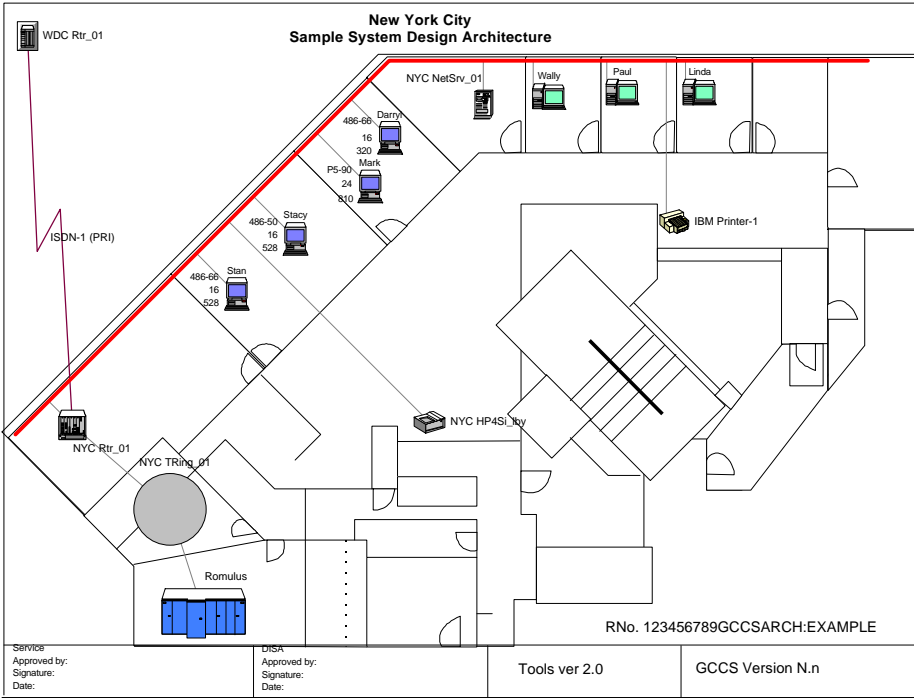

Figure C-3
Sample System Design Architecture Drawing

The reviewers studied the documentation to determine each tool's design and purpose. After gaining a good understanding of the tool's intended use, the sample architecture drawings described above were drawn using each tool. As the reviewer used the tool to create these drawings, print them, produce reports based on the data, and perform queries, the tool's suitability to support GCCS architecting and engineering efforts became apparent. During this process, Table C-1 was used to record each tool's capabilities and functionality.

It should be clearly understood that this review, and the subsequent reports, are not intended to be comprehensive evaluations or comparisons of these tools. Appendix D goes into more detail about a broader spectrum of available COTS tools. The review provided in this appendix only compares five of the several dozen tools on the market. The focus of the evaluation was on those PC-based network diagramming tools with a database. The requirements and criteria in this review can be used to evaluate other tools. The intent of this effort is simply to review the tools and determine the suitability of each one to independently support the GCCS architecture development and analyses required for implementation of GCCS worldwide.

RECOMMENDATIONS

This tool evaluation identified several tools that could complement and support the GCCS architecture methodology and conventions. Drawing, data handling, ease-of-use, and advanced features were evaluated for each tool. Although each tool has particular capabilities that could benefit GCCS, no one tool completely satisfies all foreseeable GCCS requirements. The tools listed here as "not recommended" are not necessarily bad products in and of themselves, but they are not best suited for all of the requirements for GCCS. A summary of the evaluation for each product follows.

NETVIZ. NetViz meets almost all of the functional requirements and objectives to support the GCCS community. The tool possesses the following capabilities: excellent drawing capability coupled with easy-to-use data handling capabilities, support for GCCS conventions, and a more than adequate import and export capability. netViz, like all of the other tools evaluated, is limited in network modeling and simulation, autodiscovery, and SNMP interface capabilities. netViz is best suited for easily drawing complex network diagrams for presentations and briefings. Additionally, the documentation created with netViz is useful for troubleshooting, maintenance, planning, and analysis. Highly recommended.

CLICKNET. ClickNet possesses an inadequate data display capability and no thematic layering. It requires tedious manual data entry. The data definition, reporting, and query function is inflexible, and there is no import capability for the database. Clicknet lacks modeling and simulation capabilities, autodiscovery, and SNMP interfaces. While ClickNet is not best suited for GCCS, ClickNet is an acceptable network diagramming tool that could support other applications. Not highly recommended.

SYSDRAW. SysDraw does not support GCCS conventions, thematic layering, modeling and simulation, and does not provide autodiscovery or any SNMP interfaces. While not the top choice for GCCS, SysDraw is an acceptable package for network diagramming and project management record keeping. Not highly recommended.

ASSET M/V. Although this tool possesses a simple network diagramming and documenting capability, ASSET M/V's inadequate drawing capabilities with no display of linked data in the diagram, limited import/export capability, poor usability, and poor documentation makes it unacceptable for GCCS. Not recommended.

GRAFBASE. GrafBASE possesses an inadequate drawing capability, burdensome drill down capability, no thematic layering, and an inadequate and very limited import and export capability. GrafBASE may be useful for managers needing to track costs and node location using the advanced mapping capability. Not recommended.

NETGURU. NetGuru has the following limitations: a lack of drawing capability, limited data handling functionality and features, poor print quality, and no autodiscovery or SNMP capability. NetGuru, although clearly not

designed as a diagramming and documentation tool, is well suited for providing network designers and engineers a tool for planning, designing, and easily testing networks. Not recommended.

TABLE C-1: TOOL CAPBILITIES

The glossary following this table details each of the capabilities identified in the left column of the table.

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Product					
Version Number	2.0	1.401	1.62	2.0	8.0
Release Date	1Q 1995	June 1995	July 1995	May 1995	May 1995
Hardware Requirements					
Processor	386 or better	386 or better	286 or better	386 or better	386 or better
RAM	8 MB	4 MB	4 MB	4 MB	4 MB
Hard Disk Space	25 MB	8 MB	2.5 MB	6 MB	18 MB
Operating System	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0	Windows 3.1 DOS 5.0
Suggested Retail Price	$795	$875	$1589	$595	$955
Drawing					
Drag and Drop Tool Palettes	Yes	Yes	Yes	Yes	Yes
Drill Down (Multilevel diagramming)	Yes	Yes	No	Yes	Yes
Thematic Layering	No	No	No	No	No
Engineering Borders	Yes	No		Yes	Yes
GCCS Conventions	Yes	No		Yes	No
Zoom In/Out	Yes	Yes	Yes	Yes	Yes
Standard Drawing Tools	Yes	Text only	Yes	Yes	Yes
Icon Images	Yes	Yes	Yes	Yes	Yes
Image Library	2,300	45	Yes	400	2,000
Import Images	Yes	Yes	No	Yes	Yes
Linked Data					
Display	Yes	Yes	Yes	Yes	No
Select Fields to Display	Yes	Yes	No	Yes	No
Modify Display Properties	Yes	Some	No	Yes	No
Movable Display Text	Yes	Yes	Yes	Yes	No
Links					
Smart Lines	Yes	Yes	Yes	Yes	Yes
Curve Lines	No	No	No	Yes	Yes
Bendpoints	Yes	Yes	No	Yes	Yes
Links Between Layers	No	Yes	No	Yes	Yes
Different Line Styles	Yes	Yes		Yes	No

Table C-1 (Cont'd.)
Importing Formats

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Importing					
Icon Symbol Formats					
*.BMP	Yes	Yes	No	Yes	No
*.CGM	No	No	No	Yes	Yes
*.DXF	No	Yes	No	Yes	Yes
*.DRW	No	No	No	Yes	Yes
*.EPS	Yes	No	No	Yes	No
*.GIF	Yes	No	No	Yes	No
*.ICO	No	Yes	No	Yes	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	Yes	No	Yes	No
*.TGA	Yes	No	No	No	No
*.TIF	Yes	No	No	Yes	No
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Background formats					
*.BMP	Yes	Yes	No	Yes	No
*.CGM	No	No	No	Yes	Yes
*.DRW	No	No	No	Yes	Yes
*.DXF	No	Yes	No	Yes	Yes
*.EPS	Yes	No	No	Yes	No
*.GIF	Yes	No	No	Yes	No
*.ICO	No	No	No	Yes	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	Yes	No	Yes	No
*.TGA	Yes	No	No	No	No
*.TIF	Yes	No	No	Yes	No
*.TXT	No	No	No	No	Yes
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Exporting					
Save As...					
*.BMP	Yes	Yes	No	No	No
*.CGM	No	No	No	No	Yes
*.DRW	No	No	No	No	Yes
*.DXF	No	No	No	No	Yes
*.EPS	Yes	No	No	No	No
*.GIF	Yes	No	No	No	No
*.ICO	No	No	No	No	No
*.JPG	Yes	No	No	No	No
*.PCT	Yes	No	No	No	Yes
*.PCX	Yes	No	No	No	No

Table C-1 (Cont'd.)
Exporting (Cont'd.)

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
*.TGA	Yes	Yes	No	No	No
*.TIF	Yes	No	No	No	No
*.TXT	No	No	No	No	Yes
*.WMF	Yes	Yes	No	Yes	Yes
*.WPG	Yes	No	No	No	Yes
Copy-and-paste	Yes	Yes	Yes	Yes	Partially
OLE Compatible	No	No	No	No	Yes
Print Quality	Good	Poor	Fair	Good	Good
Data Handling					
Icons Linked to Data	Yes	Yes	Yes	Yes	Yes
Modify Data Fields	Yes	Yes	No	Yes	Yes
Importing					
ASCII (delimited text)	No	Yes	No	Yes	Yes
ODBC Compliant	Yes	No	No	No	Yes
Native DBMS Formats	No	No	No	No	Yes
Exporting					
ASCII (delimited text)	Yes	Yes	Yes	Yes	Yes
ODBC Compliant	Yes	No	No	No	Yes
Native DBMS Formats	No	No	No	No	Yes
Copy (Cut)-and-paste	No	No	Yes	Yes	No
Reports					
Predefined	Yes	Yes	Yes	No	Yes
Customized	No	No	No	No	Yes
Ad-hoc	No	Yes	No	Yes	Yes
Query Capability	Partially	Yes	Yes	Yes	Yes
Query Result Formats (tabular, forms, text reports, graphs)	Built-in report facility: text report Using ODBC DBMS: as provided by DBMS	Tabular, Text	Screen list	Tabular	Forms, Reports
Ease-of-Use					
General (good, fair, poor)	Good	Fair	Fair	Good	Good
Navigation (good, fair, poor)	Good	Fair	Good	Good	Good
Documentation (good, fair, poor)	Good	Fair	Fair	Good	Good
On-Line Documentation	Yes	Yes		Yes	Yes

Table C-1 (Cont'd.)
Ease-of-Use (Cont'd.)

CAPABILITIES	ClickNet	GrafBASE	NetGuru	netViz	SysDraw
Context Sensitive Help	No	No		Yes	Yes
Bubble Help	Yes	Yes	No	Yes	Yes
Tutorials/Tours	No	Yes	No	Yes	Yes
Advanced Features					
Modeling & Simulation	No	No	Yes	No	No
Interface to SNMP-based Logical Network Mgmt.	No	No	No	No	No
Autodiscovery	No	No	No	No	No

TOOL CAPABILITIES GLOSSARY

The following glossary provides a brief description of the terms used in the table to describe the features and ratings of each tool. The table entries are very brief, and should not be used alone to understand a tool's suitability for a particular task. Before making any purchase decision, we recommend you obtain both current vendor information and the full tool reports from DISA's July 1995 evaluation of architecture tools, or another reliable, independent review. Areas in which a tool is particularly strong or weak, or in which the tool had notable problems is described in greater depth in the reports.

Product Information about the product that is administrative in nature. Product information includes:

> Version Number
>
> Release Date
>
> Hardware Requirements
>
>> - Processor
>>
>> - RAM
>>
>> - Hard Disk Space
>
> Operating System
>
> Suggested Retail Price.

Drawing Each tool needs to provide the following drawing capabilities:

> Drag and Drop Symbol Palettes - The tool provides tool palettes, or small separate windows showing icons representing the supporting tools or symbols available for use. Drag and Drop means the supporting tools or symbols can be clicked and dragged to the working area of the project for use.
>
> Drill Down (Multilevel diagramming) - The capability to click on a symbol and reveal a detailed drawing of the subsystems of the location or system represented by that symbol.

Thematic Layering - A means of layering different elements of information in one drawing or diagram, much like transparent overlays. The layers can be used to portray themes, such as network wiring, client PCs, network servers, or network devices.

Engineering Borders - The capability to draw boxes or borders around sections of a network diagram.

GCCS Conventions - The ability to support the GCCS conventions detailed in Section 3 of this document.

Zoom In/Out - The capability to change the scale of the drawing.

Standard Drawing Tools - The tool has supporting generic drawing tools, such as arrows, rectangles, circles, and text.

Icon Images

- *Image Library* - How many images the tool provides for representing information system components.

- *Import Images* - The tool provides the capability to define new icons to represent information system components and bring in images to represent them.

Data Field Display - The capability to display and print data fields contained in the database around system components in a network diagram.

- *Select Fields to Display* - The capability to select which data is displayed.

- *Modify Display Properties* - The capability to change the font, color, alignment, etc. of the displayed data.

- *Movable Display Text* - The capability to move the displayed data in the diagram.

Links - Lines connecting components, usually representing communications links.

- *Smart Lines* - Lines which remain connected and move when the attached icons are moved.

- *Curve Lines* - Lines that can be curved.

- *Bendpoints* - Lines that can have bend points added.

- *Links Between Layers* - Lines that can be drawn between components in separate drawing layers or windows. This can be demonstrated by showing the line directly connecting the layers, or by placing a specially denoted symbol on each drawing representing the opposite end connection.

- *Different Line Styles* - Lines that can be different colors, thickness, etc. to differentiate between link types.

Importing - Tools should provide capability to import images from other tool or files, such as icon images and background drawings.

- *Icon Symbol formats* - Tools must support some of these standard
  formats:
    *.BMP - Windows Bitmap
    *.CGM - Computer Graphics Metafile
    *.DXF - AutoCAD Interchange
    *.DRW - MicroGrafx Designer drawing
    *.EPS - Encapsulated PostScript
    *.GIF - Graphics Interchange Format
    *.ICO - Windows icon
    *.JPG - Joint Photographic Experts Group (JPEG) standard
    *.PCT - Macintosh PICT file
    *.PCX - PC Paintbrush
    *.TGA - Targa image
    *.TIF - Tagged Image File
    *.WMF - Windows Metafile
    *.WPG - Word Perfect Graphic

- *Background formats*
    *.BMP - Windows Bitmap
    *.CGM - Computer Graphics Metafile
    *.DRW - MicroGrafx Designer drawing
    *.DXF - AutoCAD Interchange
    *.EPS - Encapsulated PostScript
    *.GIF - Graphics Interchange Format
    *.ICO - Windows icon
    *.JPG - Joint Photographic Experts Group (JPEG) standard
    *.PCT - Macintosh PICT file
    *.PCX - PC Paintbrush
    *.TGA - Targa image
    *.TIF - Tagged Image File
    *.TXT - ASCII text file
    *.WMF - Windows Metafile
    *.WPG - Word Perfect Graphic

Exporting - Tools need to provide some capability to view and manipulate
network diagrams in other applications. This ability can be accomplished
by saving diagrams in various file formats, by copy-and-paste, or by MS
Windows Object Linking and Embedding (OLE).

- *Save As...*
    *.BMP - Windows Bitmap
    *.CGM - Computer Graphics Metafile
    *.DRW - MicroGrafx Designer drawing
    *.DXF - AutoCAD Interchange
    *.EPS - Encapsulated PostScript
    *.GIF - Graphics Interchange Format
    *.ICO - Windows icon
    *.JPG - Joint Photographic Experts Group (JPEG) standard
    *.PCT - Macintosh PICT file
    *.PCX - PC Paintbrush
    *.TGA - Targa image
    *.TIF - Tagged Image File
    *.TXT - ASCII text file

     *.WMF - Windows Metafile
     *.WPG - Word Perfect Graphic

  - *Copy-and-paste*- The capability to use the MS Windows clipboard method to copy a drawing, or portion of a drawing, and paste it into another MS Windows application.

  - *OLE Compatible*- The program can act as a MS Windows OLE server. If the program is OLE compatible, the OLE version (1.0 or 2.0) will be indicated on-line.

  - *Print Quality*- The quality and accuracy of the network diagram when printed.

Data Handling - Each tool needs some means of maintaining data or attribute information about the information system components represented in the drawings. This information may be stored in the form of a built-in database or interaction with an Database Management System (DBMS) of some kind.

Icons Linked to Data - The tool maintains data about information system components that is available (can be viewed or edited) by clicking on the icon or by some other user interaction.

Modify Data Fields - The capability to change what data is maintained for information system components by adding, deleting or modifying the data fields recorded for a component type.

Importing - The tool needs to provide the capability to import data from existing documents, databases or spreadsheets:

  - *ASCII (delimited text)*- Tool can import plain text.

  - *ODBC Compliant*- Tool can interact, or at least import, from databases using the Microsoft Open Database Connectivity (ODBC) standard as a translation layer.

  - *Native DBMS Formats*- Tool can import directly from the database using the DBMS' native database format.

Exporting - Tools need to provide the capability to export data to other applications, such as word processors, database management systems, or spreadsheets:

  - *ASCII (delimited text)*- Tool can export in plain text.

  - *ODBC Compliant*- Tool can interface databases using the Microsoft ODBC standard as a translation layer, allowing querying and other data operations.

  - *Native DBMS Formats*- Tool can be interfaced directly from a DBMS, or can save data in the DBMS' native database format.

  - *Copy (Cut)-and-paste*- Data can be copied, or cut, from the tool and pasted into another application.

Reports - Tool needs to provide the capability to generate reports on the data about the information system components.

- *Predefined* - Tool has predefined report formats, in which the content and format is predetermined.

- *Customized* - The user can define report contents and formats and save them for recurring use.

- *Ad-hoc* - The user must define the report content and format each time it is printed or displayed.

Query Capability - Tool needs to provide a capability to request specific information about the information system components diagrammed.

Query Result Formats (tabular, forms, text reports, graphs) - Tool shows which format can be used to display query results. Tabular results are in tables or spreadsheet format. Forms are displayed as fill -in-the-blank style screen forms. Text reports display query results in a text document format. Graphical reports display results in graph format.

Ease of Use - Each tool needs to be intuitive to the user and should be easy to learn with minimal training. The ease-of-use criteria are primarily subjective in nature, and should not be used other than as general indicators of the evaluators' experience in using the programs:

General (good, fair, poor) - A rating of the overall ease-of-use of the program, based on the evaluators' experience in using the program during the evaluation process.

Navigation (good, fair, poor) - A rating of the level of effort to accomplish typical tasks. Based on the number of menu levels or the amount of mouse movement and clicking required to accomplish most tasks.

Documentation (good, fair, poor) - The quality of the documentation is indicated based on clarity of instruction and accuracy of information.

On-line Documentation - The capability to search on a word or topic using the standard MS Windows hypertext help directory.

Context Sensitive Help - The ability to call up the help window related to the function the user is attempting to perform using the F1 function key.

Bubble Help - Small free floating tips and labels that appear when the cursor is held over a tool or image for a short period of time.

Tutorials/Tours - Tool included some form of computer based training in addition to on-line help information.

Advanced Features - Advanced features in which the tools may or may not have had capabilities:

Modeling & Simulation - The tool provides a capability to simulate the information system which is diagrammed, providing information on the validity of the design and performance characteristics.

Interface to SNMP-based Logical Network Mgmt - The program can get information from and provide information to logical network management systems such as Hewlett Packard's OpenView, IBM's NetView/6000, Computer Associates' UNICENTER, and Sun's NetManager.

Auto-discovery - The tool can automatically survey and record data on the systems connected to a network.

APPENDIX D.
TOOL NOTES

This appendix provides an informal overview of commercially available tools that may be applicable to GCCS architecture. Products are grouped by three main categories:

Network design

Autodiscovery

Network simulation and modeling support.

BACKGROUND

The information in this section is the result of a DISA tools evaluation task conducted in June and July, 1995. The objective of this task was to identify a cost effective suite of tools that together are flexible enough to support all facets of GCCS architecture development and analysis. The formal end product of the evaluation was a set of six reviews of architecture tools, which are summarized in Appendix C.

Appendix D captures the notes made by the evaluators at the beginning of the tools evaluation task. The evaluators conducted a quick product survey to determine what types of tools are on the market and what broad categories of functionality each one supports. This data helped the evaluators to select six tools for further evaluation, and to put the capabilities of those tools in an appropriate context.

Applicability to Your Needs

Clearly, the information in this appendix reflects a snapshot in time. It describes only the products available in a particular month and the version of each product that was current at that time.   It presents only such information as the tool evaluators needed for their limited purposes, and only what could be collected within the time available.

This information can nonetheless help you begin to investigate tools to automate critical architecture development and documentation tasks. It is recommended that you use these notes as the starting point for your own research. Some suggestions:

- Review these notes to get an idea of the range of products that are on the market, and the very different subsets of functionality that they offer.

Identify your critical needs and a few "nice-to-have" features, and focus your investigation on tools that support them.

- If the description of a tool in this appendix sounds interesting, contact the vendor for current product data. You may also be able to obtain a short-term or limited-capability demonstration copy of the tool.

- Once you know the type of tool you want, consult computer magazines and other non-vendor information sources to get specific information on capabilities, ease of use, and customer satisfaction. Appendix C provides an impartial evaluation of six tools that are applicable to GCCS architecture work.

- You may conclude that it is more practical to look at a number of tools rather than trying to find a single product that does it all. The keys to assembling an effective suite of tools are to look for ones that allow import and export of information, and to retain the flexibility to add additional tools or exchange products as requirements change or as better, more cost-effective products appear on the market.

!

> The list of products in this section is not to be used as a buying guide. Always get current product data and independent evaluations or the opinions of current users before making a purchase decision.

NETWORK DESIGN

The packages for network design address the functionality for network diagramming, documentation, and presentation. The commercial offerings that may best support GCCS architecture development and analysis are highlighted in this section. Product descriptions are limited to packages that operate in an MS Windows environment, the environment that most GCCS architects and engineers utilize. There are several high-powered, higher-priced packages available to provide specific functionality using a variety of competing platforms. Cost was also a factor in determining which products to investigate, as most organizations have difficulty supporting the initial purchase of a high-cost package, required training, and a long-term commitment to continual, expensive upgrades. The packages indentified include:

- **ShapeWare Corp's Visio** - A drawing tool that focuses on common business diagrams and organizational charts, flow diagrams, office space plans, geographic maps, and network diagrams. The package offers a selection of 150 network shapes.

- **Network World's NetDraw Plus** - This is less of a drawing tool and more of a clip-art library with multilevel diagrams and maps and 1,100 clip-art images. It offers smart line tools to connect objects, which means that when

objects move on the screen, connecting lines are automatically moved to preserve the original relationships between elements.

- **MicroSystems Engineering Co's SysDraw** -   This package offers premium hardware images with more than 1,200 clip-art images with detailed depiction's of routers, hubs, printers, etc. from scores of manufacturers. SysDraw is a network illustration tool that allows you to create detailed representations of computer networks and telecommunication systems. SysDraw comprises over 2,000 exact replica images of hardware and networking devices to document the essential components of LANs, WANs, and client/server systems. The user selects the desired images and drags and drops them onto the SysDraw screen. SysDraw includes a complete technical illustrator to modify existing images or create new device images or logos. A listing of some devices include bridges and routers, file servers, patch panels and outlets, and workstations, to name just a few.

- **PinPoint Software's ClickNet 2.03a** - ClickNet offers over 1,300 images and more than 20 management reports. ClickNet Professional Edition adds integrated database and reporting capabilities to the robust network diagramming functionality already contained within ClickNet Standard Edition.   ClickNet Professional Edition is one of the most complete, highest-quality tools currently available for the documentation, design, and analysis of networks. It provides the capability to store multiple levels of information visually keyed to icons and smart lines; to access the dynamic database by clicking on individual icons within the diagram; and to select from any of 25 predefined, ready-to-run management reports. It has an easy-to-use graphical user interfaceand operates under MS Windows

- **Quyen Systems' netViz** - This package offers 300 images. netViz is a network diagramming and documentation tool, combining object-oriented graphics and data management. This unique business graphics tool is ideal for diagramming computer networks and flowcharts or any other type of diagrams (workflow, dataflow, etc.).   Its support for multilayered hierarchies makes it possible to document large and complex projects and networks. Users can import over 30 types of graphic file formats to use in their diagrams, and can export diagrams as Windows metafiles (*.wmf). Users can also import and export data in ASCII format. netViz provides for fast and superb printing to any Windows-driven device. Users can copy and paste graphics through the clipboard for fast updating of reports and presentations.

- **American Hytech's NetGuru** - NetGuru allows the network professional to quickly design, illustrate, and document networks. NetGuru Manager will validate a network design based on IEEE standards with an internal rule-checking utility. It is the only planning package that depicts all of the functional components of a network including network interface cards, converters, terminators, transceivers, MAUs, bridges, repeaters, routers, hubs, and different cable types. Networking palettes supported include Ethernet, token-ring, ARCNET, and internetworking. NetGuru Manager also contains an embedded information database and custom report writer

that provides network inventory management functionality with a visual graphical interface to the network layout.

- **Auto-trol Technology's Konfig** - Konfig is a network asset/configuration management application. Konfig allows you to build intelligent relationships between devices, between devices and networks, and between networks and subnetworks through a relational database management system. Then, through the graphic engine, this program automatically provides network administrators and technicians with on-screen visual representations of the network and network devices. The network can be viewed in multiple perspectives, including logical view (network topology), physical view (network topology with physical connectivity), facility view (physical layout of the network superimposed on a facility drawing), and device view (port-level connectivity).

- **Network Dimensions, Inc. GrafBASE** - GrafBASE is a graphical database for network information and configuration management providing multiple nested views of network and equipment layouts. GrafBASE allows the user to manage and access network information in an interconnected WAN, metropolitan area network, campus network and LAN. GrafBASE maintains network information in a single application for visual representation, reporting data access, presentations, planning and tracking. The strength of GrafBASE is the accurate geographical tracking and reporting. Nodes can be located by geolocation, zip code, or area code. Location distance can be automatically calculated to provide a WAN analysis to support cost and performance trade-offs. The network mapping feature maps a WAN hierarchically from a world view to a specific country, zooming for further expansion to a county or metropolitan area. Funding information and tariffs can be input based on mileage or boundary rates to conduct the WAN cost trade-off studies.

- **Apsylog's Cable System Manager** - Cable System Manager (CSM) is a Windows-based application tool that provides a physical overview of a network topology. The network is described through a series of drawing tools, a library of icons, and text entries. The icons are designed for typical LANs and telephone systems with patch panels, hubs, outlets, computers, and phones. CSM will also automatically calculate cable load and validate architectural designs using a rules based data base. CSM can export data to text files or spreadsheet for use in other tools and packages for presentation and analysis

AUTODISCOVERY

Autodiscovery is the automatic detection of various nodes on a network. The packages identified can provide automatic node discovery and diagramming support using standard analyzers and probing agents. The packages identified include:

- **HavenTree NodeMap --** NodeMap automatically generates diagrams of Novell NetWare networks. It provides the means for graphically defining current and proposed networks. Diagrams can be exported into AutoCAD,

PageMaker, and WordPerfect. NodeMap allows for the choice of operational (i.e., high level of technical detail) and executive (i.e., summary) views.

- **Neon Software's LANsurveyor --** LANsurveyor automatically creates an AppleTalk network map which displays network objects such as networks, routers and end-nodes, and the logical relationships among them. It prints, saves and exports to create documentation for network planning. LANsurveyor queries network objects in real time for details including SNMP data, responder information, printer status, zone information and AppleTalk services. It provides customizable maps to meet individual management needs, and allows users to attach notes, import new icons, expand and contract segments to include end-nodes or display basic connectivity, change the map's orientation, and choose how the map should be labeled.

- **NetLabs/AssetManager** - AssetManager is the first application that helps automate the process of finding and tracking valuable hardware and software resources. NetLabs/AssetManager is designed to help automate the process of asset management. Its user interface is sufficiently intuitive to enable users with varying levels of technical knowledge to obtain information to support programmatic and technical needs. AssetManager is seamlessly integrated with the leading network and systems management platforms and with the Asset SuperAgent from SynOptics Communications. NetLabs/Asset-Manager provides a superior alternative to manually collecting asset information.

- **Safetynet Inc.'s ProfileNet** - ProfileNet provides enterprise-wide inventory scanning and asset management capabilities. It allows inventory data to be organized by server, department, division, etc. ProfileNet automatically scans workstations at selectable intervals with inventory data saved to the server. Inventories include hardware and software detected with overrides, configuration file editing, definable fields and a free-form notepad. Threshold alerts and query-based reporting are also provided.

- **Accugraph's Physical Network Management System** - This is a physical network management system that links to HP's OpenView, Sun's SunNet and IBM's NetView/6000 packages with the ability for automatic node discovery. The Physical Network Management System features a suite of tools for automated design, network modeling and graphical links to an industry standard RDBMS. It uses expert systems technology for network analyst functions as well to assist in troubleshooting and network documentation. With the automatic node discovery feature, Physical Network Management System can also provide managers with an automated notification of events or changes in the network topology as they occur on-line.

- **Castle Rock Computing's SNMPc** - SNMPc is an autodiscovery and drawing package for SNMP-based networks. It provides customization features and a general purpose interface to manipulate standard and imported MIBs. SNMPc supports various documentation features such as hierarchical mapping, automatic node discovery, event action filters, data

exchange and an application programming interface. The intended market for SNMPc is two-fold, small to medium sized networks and large geographically dispersed networks. For small to medium sized networks, it is used as a monitoring and management package or as a configuration tool for hubs, bridges, and routers. In larger networks, SNMPc can be used to help distribute monitoring and management tasks. SNMPc works with MIB information designed with a point and click interface for all MIB groups. Groups and table entries can be modified, added/deleted, graphed or listed in realtime. Tables can be downloaded, new MIB tables can be created, and users can define menu options that perform any command sequence on a particular data object. Export features include sending data to a printer, disk files or through DDE. The application also included an ASN.1 MIB compiler for importing private MIBs.

- **CoroNet Systems' CoroNet Management System (CMS)** - CMS is designed to assist users with managing their wide area networks by providing automatic discovery of network devices, links, protocols, applications, end-to-end conversation tracing, and performance measurement. CMS also provides analysis features with an expert, rules-based package to conduct what if analyses for moves, adds, and changes. CMS supports client/server network optimization, tracking application design across a network. With CMS, managers can ask such questions as who is using the network, what they are using the network for and what applications they are running, how network response times can be improved, how secure is the network and applications data, and how moves, adds, and changes will affect traffic flow. CMS responds to managers queries by: automatically discovering client/server conversations across all major network protocols in realtime, automatically detecting and tracking networked applications, including databases, e-mail, groupware, TCP/IP applications, games, and integrated suites; and penetrating through routers and across LAN and WAN segments. CMS provides a single, integrated view of such network elements as data paths, traffic loads, and client/server conversations, and performs what-if analyses recommending optimal configurations based on real network data. It offers point-and-click control through an MS Windows-based user interface and exports all key data into Excel to produce predefined and custom reports.

- **Gandalf Systems Corp.'s Passport** - This is a LAN/WAN management system that offers a set of NMS tools. These NMS tools provide several integrated features to include: a single-view management; multiple application support; internal database management; standardized support for other vendors' SNMP-based products; management information base; on-line monitoring and control of environment; collection of performance data about the network; automatic network discovery and mapping; and user-defined threshold and alarms.

NETWORK SIMULATION AND MODELING

Modeling and simulation packages are very modular and depending on the architecture development and analyses required, the appropriate modules must be selected. These products vary from a simple "add-on to another package or

tool" to very sophisticated "add-on modules for the traditional modeling and simulation engines." Most of the products require add-on packages to perform application or protocol specific functions. The tools must be carefully tailored to the type of network and planning the managers and designers will be supporting. To help simulate actual network traffic, many of the programs provide interfaces to networks or systems to probe software products and analyzers. Some of the packages also generate recommendations or optimal designs. The application may analyze and recommend "move server [Y] from the operations segment to the logistics segment". Some models feature an accounting package for financial modeling and allocating network cost during a major design upgrade.

Examples of the commercially available tools include:

- **Optimal Networks' Optimal Performance** - Optimal Performance analyzes the output of a protocol analyzer. Software provides for optimization, capacity planning and design of enterprise networks. It provides specific optimization recommendations and previews of future designs and changes using actual network performance data. It performs in-depth analyses and simulations in order to receive lists of network optimization recommendations.

- **Abstraction Software's Prophesy -** Prophesy is designed to assist users with modeling LANs, WANs, or any other workflow environment for day-to-day management and optimization. Prophesy features a fully integrated visual, interactive, modeling interface, with the ability to enter definitions using prompted screens. In addition, Prophesy provides the ability to produce a summary results file which is exportable to other programs. Prophesy also has an embedded confidence analysis tool, supporting up to three priority levels per queue and multiple input queues per resource. Prophesy provides realtime interfacing with Excel or other user programs, on-line help along with an interactive tutorial, message animation, Wizards, and a cost calculation model.

- **Systems and Network's Block Oriented Network Simulator (BONeS) Designer -** BONeS is a graphical network tool for designing, simulating, and analyzing networks. Its interactive approach to design and analysis is based on hierarchical block diagrams and event-driven Monte Carlo simulation techniques. Rather than writing code, users interconnect blocks to specify network devices, topologies, data structures and protocol functions. This graphical approach depicts the transformation that messages and packets undergo as they flow through the network. The package's modeling framework encompasses Petri nets, finite state machines, and other modeling paradigms. Users may evaluate how overall performance is impacted by changes in network technology, traffic, link quality, and protocols. An animation feature demonstrates data flow and protocol operation, and identifies bottlenecks. The resource allocation feature allows users to consider factors such as allocation of memory, virtual circuit numbers, and the processing power of CPUs in a network.

- **American Hytech's NetGuru Simulator -** NetGuru Simulator is a fully functional network simulation module that is used in conjunction with

NetGuru Manager to determine the cause of network performance problems before adding or moving hardware. After the user identifies the network loads generated by each of the workstations on the network, NetGuru Simulator graphically depicts and lists performance metrics based on the current network design. Graphical and textual outputs include network and media utilization, throughput, response time, transfer time, packet transmission, and packet collisions by network node. The user may quickly change the network design used for simulation to test alternatives to support optimization of network performance.

- **CACI's Comnet III** - Comnet III imports data from HP's OpenView and is designed to support what-if analyses. COMNET III provides the user with the ability to predict performance and plan for capacity changes by simulating Ethernet, token-ring, FDDI, or a host of WAN technologies including ATM, Frame Relay, SNA, X.25, etc.

- **Make Systems' NetMaker XA Planner** - NetMaker XA is an integrated suite of network decision support tools that helps users visualize network data (Visualizer); interpret traffic (Interpreter); plan capacity (Planner); test resiliency (Analyzer); optimize design (Designer); and allocate costs (Accountant). NetMaker XA tools automate the data gathering and analysis tasks, help recognize potential problems, analyze impact of change, optimize cost versus performance, and improve the quality and accuracy of decisions. With its client/server architecture, NetMaker XA tools can be shared among users and departments.

- **Network Performance Institute's LAN-Model** - LAN-Model is a basic queuing model designed for less sensitive realtime analyses or when insufficient data exists to perform statistical modeling of network performance.

- **MIL 3's OpNet Modeler -** OpNet Modeler is a software environment for modeling, simulating, and analyzing the performance of communications networks, computer systems and applications, and distributed systems. OpNet Modeler provides a GUI that supports multi-windowing, makes use of menus and icons, and operates under X Windows. Graphical object-oriented editors for defining topologies and architectures closely resemble the actual systems, allowing an intuitive mapping between a system and its model.

  The OpNet Modeler Process Editor provides a language to design models of protocols, resources, applications, algorithms, queuing schema, and other processes. Specification of model elements is performed in the Proto-C language, which combines a graphical state transition diagram approach with a library of approximately 300 communication and simulation specific functions. Simulations generate user selected performance and behavioral data. Simulation results can be plotted as time series graphs, scatter plots, histograms, and probability functions. It provides an animation capability for visualizing simulation events. OpNet Modeler also provides open system features, including interfaces to standard languages, the ability to take advantage of third-party clip-art libraries, an API, access to databases and data files, and PostScript and TIFF export filters for desktop publishing.

- **Quintessential Design's Network Performance Analyzer** - Network Performance Analyzer analyzes the performance for an entire WAN. Network Performance Analyzer provides detailed analysis reports of traffic loads, response characteristics, line loading and queuing delays. It constructs response time curves, logical and geographical maps.

APPENDIX E. ANNOTATED BIBLIOGRAPHY

This section provides:

> *An annotated list of resources that were used to develop this guidebook, and which can be useful references for you*

> *A list of supplemental references from which more perishable or narrowly focused material was derived.*

ANNOTATED REFERENCES

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strategic areas critical to the evolution of DII. The DII Architecture is a strategic enterprise architecture that focuses developers of systems within the DII by providing standards for data, applications, computing, communications, security, and management activities.

Defense Information System Network (DISN) Architecture, Baseline Coordination Draft, DISA, December 8, 1993. This document defines a goal DISN architecture and a preferred evolution strategy for achieving that goal through assessments of architecture and transition strategy alternatives. The DISN architecture establishes an integrated goal architecture and intermediate targets architectures with a time-phased decision roadmap that prescribes the steps to implement each intermediate target through the year 2000.

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APPENDIX F.
LIST OF ACRONYMS

This section provides a list of acronyms that appear in this guidebook.

ACOM Atlantic Command
ADP Automated Data Processing
AEPDS Automated Processingand Dissemination
AFFOR Air Forces
AMHS Automated Message Handling System
ARD Architecture Requirements and Definitions
ARFOR Army Forces
ATM Asynchronous Transfer Mode
AUTODIN Automatic Digital Network

Bde Brigade
Bn Battalion
Bty Battery

C4I Command, Control, Communications, Computers, and Intelligence
CAD Computer Aided Design
CBIS Computer Based Information System
CD-ROM Compact Disk - Read Only Memory
CENTCOM Central Command
CFSE Center for Systems Engineering
CINC Commander-in-Chief
CISC Complex Instruction Set Chip
CJCS Chairman of the Joint Chiefs of Staff
CM Configuration Management
COTS Commercial-off-the-Shelf
CPU Central Processing Unit

DBMS Data Base Management System
DII Defense Information Infrastructure
DISA Defense Information Systems Agency
DISN Defense Information Systems Network
DoD Department of Defense
DOS Disk Operating System
dpi dots per inch
DRAM Dynamic Random Access Memory

FAX Facsimile

FDDI   Fiber Distributed Data Interface
FORSCOM   Forces Command

GCCS Global Command and Control System
Gp   Group
GSORTS   GCCS Status of Resources and Training System

HD   Hard Drive
HQ   Headquarters

IEEE   Institute of Electrical and Electronics Engineers
ISDN   Integrated Services Digital Network

JFACCJoint Forces Air Control Central
JMCIS Joint Marines Command Information Strategy
JSOTF Joint Special Operations Task Force
JTF   Joint Task Force
JVIDS Joint Visually Integrated Display System

LAN   Local Area Network

MARFOR   Marine Forces
MB   Megabyte
MHz   Megahertz
MIB   Management Information Base

NATO North Atlantic Treaty Organization
NAVFOR   Navy Forces
NCA   National Command Authorities

OA   Office Automation
OCR   Optical Character Recognition
ODBC Open Database Connectivity
OPS   Operations

PCMCIA   Personal Computer Memory Card International Association
POSIX Portable Operating System for UNIX

RAM   Random Access Memory
Reg   Regiment
RISC   Reduced Instruction Set Chip

SATCOM   Satellite Communications
SCI   Sensitive Compartmented Information
SIPRNET   Secret Internet Protocol Router Network
SITREP   Situation Report
SNA   System Network Architecture
SNMP Simple Network Management Protocol
SONET   Synchronous Optical Network
SOP   Standard Operating Procedure
Sq   Squadron

STU   Secure Telephone Unit

TAFIMTechnical Architecture Framework for Information Management
TCP/IP Transmission Control Protocol/Internet Protocol
TELCO   Telephone Company
TS/ESI Top Secret/Extremely Sensitive Information

UPS   Uninterruptible Power Supply
U.S.   United States
USACOM   United States Atlantic Command

VRAM Virtual Random Access Memory

WAN   Wide Area Network
WS   Work Station
WWMCCS   Worldwide Military Command and Control System
WWW   World Wide Web

APPENDIX G.
POINTS OF CONTACT IN GCCS ARCHITECTURE COMMUNITY

This section provides the names and addresses of key points of contact within the GCCS architecture community.

For your reference, the following names and addresses are for key points of contact within the GCCS community with whom you may want to consult:

Mark Stiffler   Phone: (703) 696-1869
(GCCS Architect)   -1870
DISA/JIEO/CFSE   Fax: (703) 696-1972
3701 North Fairfax Drive   E-mail: stifflem@cc.ims.disa.mil
Arlington, VA 22203-1713

Daryl Wynn   Phone (703) 696-1873
NICE East   -1874
3701 North Fairfax Drive   Fax: (703) 696-1972
Arlington, VA 22203-1713   E-mail: wynnd@cc.ims.disa.mil

LTC Shawn Butler   Phone (703) 696-1873
(GCCS Engineer)   -1874
DISA/JIEO/CFSE   Fax: (703) 696-1972
3701 North Fairfax Drive   E-mail: butlers@cc.ims.disa.mil
Arlington, VA 22203-1713

APPENDIX H. BACKGROUND

This section provides:

> *Guidelines for you to follow when submitting drawings or other materials to the GCCS Architect*

> *A sample cover sheet to accompany materials submitted for archival or review.*

HOW TO SUBMIT MATERIALS TO THE GCCS ARCHITECT

With an architecture as global in scope as GCCS is, the coordination of the various architecture drawings is of paramount importance – and it can also be quite a challenge. In an effort to simplify the maintenance and centralized archival of GCCS architecture drawings, basic guidelines for submitting materials have been developed. These guidelines presented in this section will help to expedite the registration of your drawings.

What Needs to be Sent to the GCCS Architect

Section 4 addresses what materials should be sent to the GCCS Architect. The table below provides a summary.

Must Submit These	Can Submit These (not Required)
Drawings of Record	Engineering Drawings
Drawings of Acceptance	Management Drawings
Attachments/references for drawings listed above	Concept Drawings

Drawing Format for Submittal

When submitting drawings to the GCCS Architect, you are requested to submit two hard copies of your drawings and one electronic copy. Your electronic copy should be in a file format produced by one of the network diagramming tools recommended in Appendix C, although conventional drawing tools are also acceptable. Again, you are reminded to follow the standard drawing conventions outlined in Section 3 of this document.

Attaching Supplementary Materials With Your Drawings

You may want to attach supplementary materials such as references, notes, memoranda, and other supporting information for users of the drawings to consult. In such a situation, *you are reminded to mark the "Additional References" line in the "Notes" block of the drawing with a "Y"* (See Figure 3-5, "GCCS Notes"). Include the supplementary supporting data as an attachment to the drawings. Format for these materials can be drawing file, a word processing document, or simply hard copy as appropriate and available.

Standard Cover Sheet

Please include a cover sheet with each submittal to identify:

- Who is submitting the drawing, i.e., the point of contact for future coordination

- What the drawing represents

- The number and type of drawings and attachments

- Special notes for the GCCS Architect

- Any special action or review you request from the GCCS Architect

You may want to photocopy the following page and use it as a standard cover sheet.

GCCS Architecture Submittal

Date: _____

Submitted by:

Address: _____

_____

Phone (comm. and DSN):_____

Fax: (comm. and DSN):_____

The enclosed drawing is a:

❏ drawing of record

❏ drawing of acceptance

❏ other (management, engineering, concept drawing).

This drawing represents (site name and other pertinent details):_____

_____

_____

_____

Number of drawing pages:_____

Number of attachments:_____

Items on disk (list filename and source application for each):_____

_____

_____

Special notes:

_____

Special action requested:_____

_____